

What is claimed is:

1. A method of monitoring an environmental condition associated with a container containing a set of electronic components, the method comprising:

attaching an environmental condition recorder to the container, the environmental  
 5 condition recorder comprising a sensing element responsive to atmospheric moisture content, a memory storage device, and a processor electrically coupled to the sensing element and the memory storage device, the processor being configured to periodically receive information from the sensing element indicative of atmospheric moisture content and to store data in the memory storage device based on the received information.

10 2. The method of claim 1 further comprising transporting the container and the attached environmental condition recorder from a storage area to an assembly station for installing the electronic components into electronic assemblies.

15 3. The method of claim 2 further comprising accessing the data in the memory storage device with a memory reader at the assembly station.

4. The method of claim 3 wherein the memory reader at the assembly station evaluates  
 whether electronic components of the set of electronic components are suitable for installation  
 20 into the electronic assemblies, based on the data accessed by the memory reader.

5. The method of claim 2 further comprising removing a portion of the set of electronic components from the container for installation into the electronic assemblies at the assembly station.

6. The method of claim 5 further comprising transporting the container containing a remaining portion of the set of electronic components and the attached environmental condition recorder from the assembly station to the storage area.

7. A method of evaluating a set of identical electronic components prior to installing the components into electronic assemblies, the method comprising:

collecting data indicative of an environmental condition associated with the electronic components during consecutive periods of time prior to installing the electronic components from the set into the electronic assemblies;

storing the collected data;

evaluating whether the electronic components are suitable for installation based on an estimated cumulative effect of exposure to the environmental condition based on the stored data; and then, for electronic components found suitable for installation,

installing the suitable electronic components into electronic assemblies.

8. The method of claim 7 wherein collecting the data indicative of the environmental condition comprises sensing atmospheric moisture content.



9. The method of claim 8 wherein sensing atmospheric moisture content comprises measuring ambient temperature.

10. The method of claim 8 wherein sensing atmospheric moisture content comprises measuring relative humidity.

11. The method of claim 7 wherein storing the collected data comprises organizing the collected data into a graphical format plotted against a time axis.

12. The method of claim 7 wherein evaluating whether the electronic components are suitable for installation comprises estimating a remaining floor life associated with the electronic components.

13. The method of claim 12 wherein estimating the remaining floor life comprises identifying a reference time associated with a reference remaining floor life value.

14. The method of claim 13 wherein the reference time is identified as a time that collecting data indicative of the environmental condition was initiated.

15. The method of claim 13 wherein the reference time is identified based on a time that a baking event occurred.

16. The method of claim 13 wherein the reference time is identified based on a time that the electronic components experienced a prolonged exposure to a temperature greater than a preset temperature.

17. The method of claim 13 wherein the reference time is identified as a time that a final set of data was collected.

18. The method of claim 12 wherein estimating the remaining floor life comprises calculating a floor life reduction value associated with each consecutive period of time.

19. The method of claim 18 wherein estimating the remaining floor life further comprises determining a total remaining floor life value based on the floor life reduction values associated with each consecutive period of time.

20. The method of claim 12 wherein the remaining floor life is estimated based on an associated reference temperature and relative humidity.

21. The method of claim 12 wherein estimating the remaining floor life comprises accounting for a moisture sensitivity level associated with the set of electronic components.

22. The method of claim 12 wherein estimating the remaining floor life comprises accounting for a body thickness associated with the electronic components.

23. The method of claim 7 wherein evaluating whether the electronic components are suitable for installation comprises integrating a set of sensed moisture content values over time to calculate a cumulative environmental exposure factor.

5 24. The method of claim 7 wherein evaluating whether the electronic components are suitable for installation comprises comparing the estimated cumulative effect of exposure to the environmental condition to a predefined acceptance criteria to determine an estimated reliability factor.

10 25. The method of claim 7 wherein evaluating whether the electronic components are suitable for installation comprises comparing the estimated cumulative effect with a predefined acceptability criteria to determine a go/no-go type of recommendation.

15 26. A container of electronic components to be installed into electronic assemblies, the container comprising:

a storage device containing a set of electronic components; and

an environmental condition recorder coupled to the storage device and associated with the set of electronic components, the environmental condition recorder comprising sensing elements responsive to an ambient environmental condition, a processor and an associated  
20 memory storage device, the processor being configured to receive data from the sensing elements indicative of the ambient environmental condition during multiple, successive periods of time, to cumulatively and accessibly store the data in the associated memory storage device and to

evaluate whether the electronic components are suitable for installation based on a cumulative effect of exposure to the ambient environmental condition.

27. The container of claim 26 wherein the storage device comprises a shipping package  
5 containing at least one reel of identical electronic components.

28. The container of claim 26 wherein the storage device comprises a reel containing multiple identical electronic components.

10 29. The container of claim 26 wherein the storage device comprises a storage carton containing multiple identical electronic components.

15 30. The container of claim 26 wherein the storage device comprises a tray of identical electronic components.

20 31. The container of claim 26 wherein the sensing elements are responsive to ambient moisture content.

32. The container of claim 26 wherein the environmental condition recorder is removably  
20 secured to the storage device.

33. The container of claim 26 wherein the processor is further configured to create a graphical representation of the data plotted against an axis representative of time.

34. The container of claim 26 wherein the environmental condition recorder further comprises a timing element and wherein the processor receives and stores the data at predefined intervals of time as measured by the timing element.

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35. The container of claim 26 wherein the processor is further configured to communicate the stored data and a determination of whether the electronic components are suitable for installation to a remote device.

10 36. The container of claim 26 wherein the processor is further configured to estimate a remaining floor life associated with the electronic components.

15 37. The container of claim 26 wherein the processor is further configured to identify a reference time associated with a reference remaining floor life value.

20 38. The container of claim 26 wherein the processor is further configured to calculate a reduction in floor life associated with each of multiple, consecutive periods of time.

25 39. The container of claim 38 wherein the processor is further configured to calculate a cumulative total remaining floor life based on the calculated reductions in floor life associated with each consecutive period of time.

40. The container of claim 36 wherein the processor is further configured to estimate the remaining floor life based on a reference temperature value and a reference relative humidity value.

5 41. The container of claim 36 wherein estimating the remaining floor life comprises considering a moisture sensitivity level associated with the set of electronic components.

42. The container of claim 26 wherein estimating remaining floor life comprises considering a body thickness associated with each electronic component of the set.

10 43. The container of claim 26 wherein the processor is further configured to integrate a set of sensed ambient moisture content values over time to calculate a cumulative environmental exposure factor.

15 44. The container of claim 26 further comprising a light emitting diode coupled to the processor and configured to illuminate to indicate whether the electronic components are suitable for installation.

20 45. The container of claim 26 wherein the processor is further configured to compare the data to a predefined baseline to determine an estimated reliability factor.



46. The container of claim 26 wherein the processor is further configured to communicate data indicative of whether the electronic components are suitable for installation to a remote device.

5 47. The container of claim 26 wherein the environmental condition recorder is coupled to the container in such a way as to permit removal of the environmental condition recorder from the container and its subsequent reattachment to a second container.

10 48. The container of claim 26 wherein the electronic components are individual chips for installation onto a printed circuit board.

15 49. The container of claim 26 wherein the environmental condition recorder is housed within a metallic container.

20 50. A system for evaluating a set of identical electronic components prior to installing the components into electronic assemblies, the system comprising:

a storage device containing a set of identical electronic components;

an environmental condition recorder coupled to the storage device and associated with the set of identical electronic components, the environmental condition recorder configured to collect data indicative of an environmental condition over multiple, successive periods of time; and

a remote device comprising a processor and a memory storage unit, wherein the processor is configured to receive the collected data from the environmental condition recorder

and evaluate whether the electronic components are suitable for installation based on the collected data.

51. The system of claim 50 wherein the processor is further configured to estimate a  
5 remaining floor life associated with the set of electronic components.

52. The system of claim 50 wherein the processor is further configured to identify a reference time associated with a reference floor life.

10 53. The system of claim 50 wherein the processor is further configured to calculate a reduction in floor life associated with each of the multiple, successive periods of time.

15 54. The system of claim 53 wherein the processor is further configured to calculate a total remaining floor life based on the calculated reductions in floor life associated with each of the multiple, successive periods of time.

55. The system of claim 51 wherein estimating the remaining floor life is based on an associated reference temperature value and a reference relative humidity value.

20 56. The system of claim 51 wherein estimating the remaining floor life comprises considering a moisture sensitivity level associated with the electronic components of the set and a body thickness value associated with the electronic components of the set.

57. The system of claim 50 wherein the processor is further configured to integrate a set of sensed ambient moisture content values over time to calculate a cumulative environmental exposure factors.

5 58. An article comprising a computer-readable medium that stores computer executable instructions for causing a computer system to:

receive a set of time-based data representing ambient moisture content exposure for a set of uninstalled electronic components;

10 evaluate whether the set of electronic components are suitable for installation based on a cumulative effect of moisture exposure derived from the time-based data; and

15 output information indicating suitability of the electronic components for installation into electronic assemblies.

20 59. The computer-readable medium of claim 58 further comprising computer executable instructions for causing the computer system to estimate a total remaining floor life associated with the set of electronic components based on the time-based data.

25 60. The computer-readable medium of claim 58 further comprising computer executable instructions for causing the computer system to identify a reference time in the time-based data associated with a reference floor life.

61. The computer-readable medium of claim 58 further comprising computer executable instructions for causing the computer system to calculate a reduction in floor life associated with each of multiple, successive periods of time represented by the time-based data.

5 62. The computer-readable medium of claim 61 further comprising computer executable instructions for causing the computer system to calculate a cumulative total remaining floor life based on the reductions in floor life associated with each of the periods of time.

63. The computer-readable medium of claim 58 further comprising computer executable instructions for causing the computer system to calculate an integral function of sensed ambient moisture content over time to identify an environmental exposure factor.

64. The computer-readable medium of claim 63 further comprising computer executable instructions for causing the computer system to compare the calculated environmental exposure factor to a predetermined benchmark value representative of an ideal environmental exposure factor.